With SL infusion, mean RA pressure and cardiac output (CO) rose 32% and 22%, respectively. Mean arterial pressure fell by 27% with NP with little CO change. Data on C and FSPI (Mean ± SEM) were:

	EDC-S	EDC-A	EDC-P	ESC-S	ESC-A	ESC-P	ED-FSPI	ES-FSPI
BSL	6.8 ± 1	23 ± 2	−1.1 ± 1	5.5 ± 1	30 ± 3	−1.0 ± 1	20.3 ± 2	41.7 ± 4
SL	7.1 ± 1	25 ± 2	−2.2 ± 1	8.1 ± 2	23 ± 1	−1.7 ± 2	19.6 ± 2	35.8 ± 4
NP	8.4 ± 1	21 ± 2	−1.1 ± 1	5.4 ± 1	31 ± 1	−1.4 ± 2	15.6 ± 2	36.1 ± 3

% Δ in FSPI was 115 ± 28, 96 ± 30 and 145 ± 21, respectively.

(BSL = Basal; There were no significant changes in the values between experimental states). Thus end-diastolic and end-systolic C, and FSPI and % ΔFSPI were relatively unchanged despite alterations in preload and afterload. *Conclusion:* Regional and global geometry of a normal left ventricle is relatively uninfluenced by acute changes in loading conditions and CO, and LV appears to retain its shape to maintain its functional capacity.

939-119 Improved Diagnostic Method for Detecting Left Ventricular Apical Injury

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During isovolumic relaxation (IVR) regional differences in myocardial function may alter intraventricular blood flow. A new digital echocardiograph allows 2-D color Doppler flow imaging of low velocities at high frame rates, thus improving the ability to study intraventricular velocities. We used this instrument for studying IVR in patients with myocardial infarction (MI).

Methods: 16 patients with angiographically proven apical MI, 10 patients with inferior MI and 10 healthy volunteers were studied. Cineloops were digital recorded from the three standard apical positions and stored for frame by frame studies during IVR. We achieved images at mean 33 frames per sec.

Results: During IVR, 15 of 16 patients with apical MI had blue-encoded flow directed from apex to the basis confined in the apical 2/3 of left ventricle (LV). Mean area of this color flow was 7.8 cm^2 (± 5.2 cm^2) and mean velocity was 9.7 cm/s (± 4.7 cm/s). This basis directed flow was not detected in any of the inferior MI patients or normal subjects. When flow was found, (9/10 of inferior MI patients and 8/10 of normals), it was always directed towards apex being red-encoded. Color M-mode with the beam placed through the mitral tips or aorta valves confirmed these findings of flow direction. A clearly blue-encoded signal was seen during IVR in patients with apical dyskinesia. The mechanism for the reversed IVR flow in apical dyskinesia is probably delayed contraction of the apical area.

Conclusions: Intraventricular flow during IVR is successfully visualized by new generation ultrasonic technology. Abnormal flow direction towards basal parts of LV strongly indicates apical injury of the myocardium.

939-120 Correlation of Scar Thickness to Myocardial Viability in Patients with Healed Myocardial Infarction

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Experimental study documented that reperfused scar is thicker than non-reperfused scar and it tolerates the infarct expansion. We hypothesized that viable myocardium exists in the outer layer of thick reperfused scar and its intrinsic contraction attenuates the expansion. We assessed the correlation of cardiac cycle-dependent variation (CV) of integrated backscatter (IB), that reflects intrinsic contractile performance, of inner and outer layers to the scar thickness in 13 patients with myocardial infarction (MI). We recorded magnified short-axis IB images with Acoustic Densitometry. We placed ROI in the inner and outer layers of akinetic segments to measure magnitude of CV (dB). When CV showed synchronous and asynchronous patterns, we expressed the magnitude as positive and negative value (corrected magnitude), respectively. Patients were divided into two groups based on scar thickeness: Gr-A (n = 9), ≤ 9 mm and Gr-B (n = 4), > 9 mm.

	Gr-A (n = 9)	Gr-B (n = 4)
Outer layer	-4.2 ± 3.0 dB (90%)	2.0 ± 0.4 dB* (0%)
Inner layer	-4.3 ± 1.5 dB (100%)	−0.7 ± 2.9 dB* (50%)

*P < 0.05 vs Gr-A, ( ): % asynchrony

The majority of Gr-A showed asynchronous contraction in both inner and outer layers, but all of Gr-B showed synchronous in the outer layer. Thus, there may be viable myocardium especially in outer layer of the thick scar. Intrinsic contraction of the outer layer may have a role to restraint passive stretching of infarct segment in patients with OMI.

939-121 Accuracy of Color Kinesis Technique for Quantitative Evaluation of Regional Wall Motion During Dobutamine Stress Test

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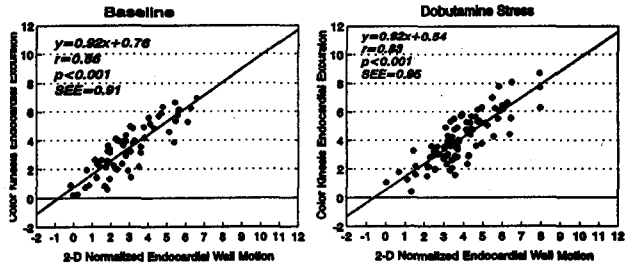
Color kinesis with a color encoded endocardial motion map may provide quantitative wall motion data during dobutamine stress echo (DSE), but the accuracy of this technique in stress conditions with tachycardia, exaggerated cardiac rotation and translation has not been tested. This study evaluated the accuracy of this system in 25 stages of regional LV dysfunction resulting from an LAD stenosis in 3 pigs during DSE. 2-D and color kinesis images were recorded at the mid-papillary muscle level. Sonomicrometers were implanted in mid anterior and inferior LV walls. The area of systolic endocardial excursion on the color kinesis map was digitized, analyzed by a modified centerline method and divided into 8 regions. 2-D LV endocardial borders were traced and analysed with a centerline method. *Results:* Regional endocardial excursion on the color kinesis map correlated well with regional wall motion on 2-D echocardiograms, both at baseline and during DSE (Figures). A good correlation was also seen between was sonomicrometers and color kinesis (r = 0 91, p < 0.01).



Conclusions: The color kinesis endocardial excursion mapping technique accurately quantifies regional wall motion. This new tool may lead to automation of wall motion quantification during DSE.

940 Nuclear Cardiology: New Approaches

Monday, March 17, 1997, Noon–2:00 p.m.
Anaheim Convention Center, Hall E
Presentation Hour: Noon–1:00 p.m.

940-97 Prediction of Outcome After Cardiac Transplantation Using Exercise SPECT Perfusion Imaging

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This study examined the prognostic value of exercise SPECT perfusion imaging in 71 patients performed after cardiac transplantation. There were 61 men and 10 women with a mean age of 53 ± 10 years. The mean exercise heart rate was 127 ± 22 bpm and exercise work load 6 ± 3 METS. During a mean follow-up of 26 ± 17 months, there were 6 cardiac events (3 deaths and 3 nonfatal myocardial infarctions). There were 3 events amongst the 7 patients with abnormal SPECT and 3 events amongst the 64 pts with normal SPECT (P < 0.001). The Kaplan Meier event-free survival was significantly better in patients with normal than abnormal SPECT (95% vs 57%, P < 0.0001). The annual event rate was 2% in patients with normal SPECT and 20% in patients with abnormal SPECT (P < 0.001).

Thus, stress SPECT perfusion imaging is useful in predicting outcome after cardiac transplantation. Events are infrequent in patients with normal images, but the progressive nature of coronary arteriopathy in some patients necessitates serial testing.

940-98 Comparison of the Prognostic Value of MIBG Uptake and Peak Exercise Oxygen Uptake in Chronic Heart Failure

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Decreased cardiac meta-iodo benzyl guanidine (MIBG) uptake has been

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found to reflect alterations in adrenergic nerve function that have a critical influence on the adverse outcome of patients with congestive heart failure (CHF). This alteration has been shown to be of high prognostic value in comparison with resting hemodynamic indices in end-stage CHF patients. However, the comparison with another major prognostic index, peak exercise oxygen uptake (peak VO_2), has not yet been done.

We prospectively studied 93 consecutive ambulatory CHF patients (age 55 ± 10 years) with an ejection fraction <45% (mean 25 ± 10). Cardiac MIBG uptake was measured as the heart to mediastinum activity ratio on the planar image (10-min acquisition in the chest anterior wiew) obtained 4 h after a 111 to 148 MBq IV injection of I-123 MIBG (H/M, mean 133 ± 21%, normal values: 192 ± 42%). Peak VO_2 was measured during cycle exercise (mean 20 ± 6 ml/min/kg).

During a mean follow-up of 10 ± 8 months, 10 patients died and 22 had heart transplantation. Peak VO_2 ($p < 0.0001$) and MIBG H/M ($p = 0.02$) were predictive of death or transplantation by Cox univariate analysis. Using multivariate analysis, only peak VO_2 predicted outcome. When transplantation events were censored, only peak VO_2, normalized either by body weight or by predicted values, emerged as predictor of outcome ($p < 0.05$). Kaplan-Meier analysis confirmed the greater prognostic value of peak VO_2.

We conclude that in this population of ambulatory CHF patients, altered adrenergic nerve function has lower prognostic value than exercise capacity.

940-99 Myocardial Uptake of Radiolabeled Antimyosin Antibody Mirrors Histopathological Fibrosis in Experimental Aortic Regurgitation

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We have previously shown that (1) exuberant myocardial fibrosis invariably accompanies, and may cause, *myocytolysis* when chronic experimental aortic regurgitation (eAR) leads to heart failure (CHF) and (2) myocardial uptake of In-111-labeled antimyosin antibody (AA) in vivo is greater in chronic eAR than in acute eAR or normal. To validate AA uptake as an index of fibrosis in AR, we assessed relative heart AA concentration ([% injected dose/gm] × body wt) vs fibrosis score (Masson's Trichrome stain and a 100 point grid counting system) in 30 New Zealand white rabbits (19 with surgically induced severe AR, 11 sham-operated/normal) given 1–1.5 mCI In-111-labeled AA Fab Fragment (Myoscint) i.v. and sacrificed 48 hr later for tissue counting and histology. Fibrosis score in AR animals sacrificed subacutely (3–5 wks of AR; n = 11, 0 with CHF or subnormal ejection fraction [EF]) was 6.6 ± 4.3 vs 6.2 ± 1.8 for age matched controls (n = 5, NS); in chronic eAR animals (98–128 wks of AR; n = 8, 0 with CHF/subnormal EF) score was 8.3 ± 2.7 vs 5.3 ± 3.6 for age-matched controls (n = 6, $p < 0.1$). Among AR and age-matched control animals, relative heart AA concentration correlated with fibrosis score ($r = 0.6$, $p = 0.03$) despite absence of CHF or severe fibrosis. Thus in eAR, myocardial uptake of In-111-labeled AA quantitatively reflects myocardial fibrosis, probably pathogenic for myocardial damage, even when CHF is absent; therefore, external AA imaging may permit detection of fibrosis before cardiac functional and clinical deterioration in AR.

940-100 Effects of Transmyocardial Laser Revascularization on Myocardial Perfusion

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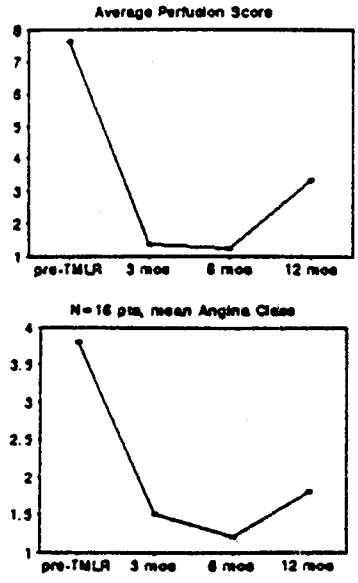
The effects of Transmyocardial Laser Revascularization (TMLR) on left ventricular (LV) Myocardial Perfusion (MP) have not been thoroughly examined. 16 consecutive patients (pts), ten men and six women (age range 45–76 yrs, mean 64) were followed at 3, 6 and 12 month intervals following TMLR. MP studies were obtained using IV dipyridamole over 4 min with 3.5 mCi of Thallium-201 (Tl) given 3 min later. MP imaging was done both immediately and at 3 hours following Tl infusion. Finally, 1.5 mCi of Tl was given and a third set of images was obtained. All images of the LV segments: anterior, lateral, inferior, posterior and septal were scored on a scale of 0–4+ by two independent observers who were blinded as to the lased segments (0 = nl, 2+ to 3+ = moderately severe ischemia, 4+ = severe ischemia). There were no deaths, myocardial infarctions or further revascularization procedures done on these pts during their first year of follow-up.



MP improves during the first year after TMLR, and parallels the changes observed in angina pectoris.

940-101 Accuracy of Spiral Computed Tomography for Identifying Internal Mammary Artery and Saphenous Vein Bypass Graft Patency

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Background: Spiral computed tomography (SCT) is an particularly useful imaging method for vascular structures, i.e. coronary grafts. Prior investigations concentrated on evaluation of saphenous vein grafts after surgery. The value of SCT in visualizing internal mammary bypass graft patency has not been well studied. Hence the aim of this study was to determine the value of high resolution SCT scanner in visualization both arterial and venous bypass grafts two years after surgery. *Methods:* Forty-nine patients (age 61.1 ± 7.9 years, 45 men) who had undergone CABG procedure were examined by SCT (Siemens Somatom plus 4) and angiography 22.2 ± 5.9 months after surgery (n = 49). In total, 134 bypass grafts (42 IMA and 92 venous grafts) were analyzed. With SCT contiguous data set of the heart was acquired which allowed segmental and three-dimensional visualization of the length of grafts. *Results:* The patency rate of the CABG, determined angiography was 75.7% (IMA, n = 36/42) and 73.9% (venous grafts n = 68/92). By SCT, 32 IMA and 64 venous grafts were diagnosed correctly as patent. Thus, the sensitivity was 88.9% (IMA) and 94.1% (venous grafts). None of correctly occluded venous grafts was diagnosed falsely patent by SCT (specificity 100%), where the specificity of IMA graft visualisation was somewhat lower (83.3%). The accuracy of SCT (predictive value for patency of a graft) was 88.1% (IMA) and 95.7% (venous CABG), respectively. Sensitivity, specificity and accuracy did not differ significantly between IMA or venous grafts (p = NS).

Conclusions: The recent generation of SCT scanner is able to assess the coronary graft patency with high sensitivity, specificity and accuracy. Both, saphenous vein grafts and IMA grafts can be assessed with an accuracy of about 90%. SCT is a fast and non invasive technique allowing the accurate evaluation of graft patency in the long term.

940-102 Are the Predictors of Hard and Soft Events Similar in Patients with Stable CAD?

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This study examined the predictors of hard events (death and non-fatal myocardial infarction [MI]) and soft events (late revascularization > 3 months) in 1007 pts with stable CAD who underwent coronary angiography and stress SPECT perfusion imaging. There were 680 men and 327 women aged 61 ± 11 years. During a mean follow-up of 46 ± 26 months, there were 159 hard events (67 deaths and 92 non-fatal MIs) and 195 soft events (PTCA or CABG). Uni- and multi-variate Cox survival analysis on important clinical, stress, catheterization and SPECT variables identified the extent of the total perfusion abnormality (fixed and reversible) as the best predictor of total